Macroheterocycles 2017 vol.10 N2, pages 226-232

Pillar[5]arenes bearing amide and carboxylic groups as synthetic receptors for alkali metal ions

Yakimova L., Shurpik D., Makhmutova A., Stoikov I.
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

Abstract

© ISUCT Publishing. Pillar[5]arenes bearing amide and carboxylic groups have demonstrated recognition performance for some representative alkali metal ions including Li + , Na + , K + and Cs + in series cations of s- and d-metals compared to pillar[5] arenes with hydroxyl, methoxy and acetone fragments. Their complexation abilities toward these cations were evaluated by UV–Vis technique. The complexation results revealed that pillar[5] arene, containing glicylglicyne groups, were the most efficient cation receptors for Li + , Na + , K + and Cs + over other synthesized and studied pillar[5]arenes. Introduction of long glycylglycide fragments into macrocycle structure allowed to increase the association constant logarithm in the case of Li + by 2 orders. In addition, in the set of macrocycles, incorporation of the additional amide fragments and carboxyl group into macrocycle structure leads to increasing the binding efficiency with alkali metal cations.

http://dx.doi.org/10.6060/mhc170511s

Keywords

Heterocycle, Macrocycle, Molecular recognition, Pillar[5]arene, Synthesis

References

[1] Leininger S., Olenyuk B., Stang P.J. Chem. Rev. 2000, 100, 853–908.
[2] Gorbachuk V.V., Yakimova L.S., Mostovaya O.A., Bizyaev D.A., Bukharaev A.A., Antipin I.S., Konovalov A.I., Zharov I., Stoikov I.I. Silicon 2011, 3(1), 5–12.
[3] Yang L., Tan X., Wang Z., Zhang X. Chem. Rev. 2015, 115, 7196–7239.
[4] Sayed M., Pal H. J. Mater. Chem. C 2016, 4, 2685–2706.
[5] Gorbatchuk V.V., Savelyeva L.S., Ziganshin M.A., Antipin I.S., Sidorov V.A. Russ. Chem. Bull. 2004, 53(1), 60–65.
[6] Yakimova L.S, Ziatdinova R.V., Evtugyn V.G., Rizvanov I.K., Stoikov I.I. Russ. Chem. Bull. 2016, 65(4), 1053–1060.
[7] Dong S., Zheng B., Wang F., Huang F. Acc. Chem. Res. 2014, 47, 1982–1994.
[8] Vavilova A.A., Nosov R.V., Mostovaya O.A., Stoikov I.I. Macroheterocycles 2016, 9, 294–300.
[9] Vavilova A.A., Nosov R.V., Yakimova L.S., Antipin I.S., Stoikov I.I. Macroheterocycles 2013, 6, 219–226.
[10] Puplampu J.B., Yakimova L.S., Vavilova A.A., Fayzullin D.A., Zuev Y.F., Stoikov I.I. Macroheterocycles 2014, 7, 337–344.
[11] Nosov R.V., Stoikov I.I. Macroheterocycles 2015, 8, 120–127.
[12] Nosov R.V., Stoikov I.I. Macroheterocycles 2014, 7, 345–350.
[13] Puplampu J.B., Yakimova L.S., Vavilova A.A., Rizvanov I.K., Stoikov I.I. Macroheterocycles 2015, 8, 75–80.

[14] Gorbatchuk V.V., Ziganshin M.A., Savelyeva L.S., Mironov N.A., Habicher W.D. Macromol. Symp. 2004, 210, 263–270.

[15] Gorbatchuk V.V., Gatiatulin A.K., Ziganshin M.A., Gubaidullin A.T., Yakimova L.S. J. Phys. Chem. B 2013, 117, 14544–14556.

[16] Jie K., Zhou Y., Yao Y., Huang F. Chem. Soc. Rev. 2015, 44, 3568–3587.

[17] Si W., Xin P., Li Z.T., Hou J.L. Acc. Chem. Res. 2015, 48, 1612–1619.

[18] Smolko V.A., Shurpik D.N., Shamagsumova R.V., Porfireva A.V., Evtugyn V.G., Yakimova L.S., Evtugyn G.A. Electrochim. Acta 2014, 147, 726–734.

[19] Liz D.G., Manfredi A.M., Medeiros M., Montecinos R., Gómez-González B., Garcia-Rio L., Nome F. Chem. Commun. 2016, 52, 3167–3170.

[20] Ogoshi T., Yamagishi T., Nakamoto Y. Chem. Rev. 2016, 116, 7937–8002.

[21] Shurpik D.N., Padnya P.L., Evtugyn V.G., Mukhametzyanov T.A., Khannanov A.A., Kutyreva M.P., Stoikov I.I. RSC Adv. 2016, 6, 9124–9131.

[22] Yakimova L.S., Shurpik D.N., Gilmanova L.H., Makhmutova A.R., Rakhimbekova A., Stoikov I.I. Org. Biomol. Chem. 2016, 14, 4233–4238.

[23] Shurpik D.N., Yakimova L.S., Makhmutova L.I., Makhmutova A.R., Rizvanov I.K., Plemenkov V.V., Stoikov I.I. Macroheterocycles 2014, 7, 351–357.

[24] Shurpik D.N., Yakimova L.S., Rizvanov I.K., Plemenkov V.V., Stoikov I.I. Macroheterocycles 2015, 8, 128–134.

[25] Yakimova L.S., Shurpik D.N., Stoikov I.I. Chem. Commun. 2016, 52, 12462–12465.

[26] Boinski T., Szumna A. Tetrahedron 2012, 68, 9419–9422.

[27] Ogoshi T., Aoki T., Kitajima K., Fujinami S., Yamagishi T., Nakamoto Y. J. Org. Chem. 2011, 76, 328–331.

[28] Shurpik D.N., Padnya P.L., Basimova L.T., Evtugin V.G., Plemenkov V.V., Stoikov I.I. Mendeleev Commun. 2016, 25(6), 432–434.

[29] Yushkova E.A., Stoikov I.I., Zhukov A.Yu., Puplampu J.B., Rizvanov I.K., Antipin I.S., Konovalov A.I. RSC Adv. 2012, 2, 3906–3919.

[30] Stoikov I.I., Mostovaya O.A., Yantemirova A.A., Antipin I.S., Konovalov A.I. Mendeleev Commun. 2012, 22(1), 21–22.

[31] Stoikov I.I., Yushkova E.A., Zhukov A.Y., Zharov I., Antipin I.S., Konovalov A.I. Tetrahedron 2008, 64, 7489–7497.

[32] Ogoshi T., Hashizume M., Yamagishi T.A., Nakamoto Y. Chem. Commun. 2010, 46, 3708–3710.

[33] Li C., Shu X., Li J., Chen S., Han K., Xu M., Jia X. J. Org. Chem. 2011, 76, 8458–8465.

[34] Li H., Chen D.X., Sun Y.L., Zheng Y.B., Tan L.L., Weiss P.S., Yang Y.W. J. Am. Chem. Soc. 2013, 135, 1570–1576.

[35] Ogoshi T., Masaki K., Shiga R., Kitajima K., Yamagishi T.A. Org. Lett. 2011, 13, 1264–1266.

[36] Cao D., Meier H. Asian J. Org. Chem. 2014, 3, 244–262.

[37] Dube L.E., Patel B.A., Fagan-Murphy A., Kothur R.R., Cragg P.J. Chemical Sensors 2013, 3, 18.